JRHS
Journal of Research in Health Sciences
journal homepage: www.umsha.ac.ir/jrhs

Original article

Association of Serum 25-Hydroxyvitamin D Levels and Vitamin D Dietary Intake with Metabolic Syndrome: A Case Control Study

Laleh Ghanei (MD)[a], Amir Ziaee (MD)[a*], Parsa Rostami (MD)[a], Sonia Oveisi (PhD)[a], Neda Esmailzadehha (MD)[a], Amir Mohammad Kazemifar (MD)[a], Ali Zargar (MD)[a]

[a] *Metabolic Diseases Research Center, Qazvin University of Medical Sciences, Qazvin, Iran*

ARTICLE INFORMATION

Article history:
Received: *01 October 2014*
Revised: *08 November 2014*
Accepted: *03 December 2014*
Available online: *09 December 2014*

Keywords:
Vitamin D Deficiency
Metabolic Syndrome
Iran

**** Correspondence***
Amir Ziaee (MD)
Tel: *+98 281 3360084*
Fax: *+98 281 3326033*
E-mail: *aziaee1963@yahoo.com*

ABSTRACT

Background: Association between the vitamin D deficiency and metabolic syndrome (MetS) has previously been noted and reported to be controversial. The aim of this study was to determine the association of serum 25 (OH) D Level and Vitamin D dietary intake with MetS among Iranian population.

Methods: This analytical study was conducted on 122 patients with MetS based on the ATPIII criteria and 128 subjects without MetS as control from September 2010 to April 2011. Serum levels of calcium, phosphorus and 25(OH) D were compared between the two groups. A food frequency questionnaire (FFQ) was used to calculate dietary intake. Data were analyzed using Chi- square test, *t*-test, Mann-Whitney U test and logistic regression analysis.

Results: Serum concentrations of 25 (OH) D, calcium and phosphorus and calcium intake were significantly lower in subjects with MetS compared to the subjects without MetS. 98.4% of subjects with MetS and 88.3% without MetS had Vit. D deficiency and this difference was statistically significant (P=0.005). In regression analysis, lower concentration of serum 25 (OH) D, calcium and phosphorus and lower calcium and diary intake were predictors of MetS.

Conclusions: Serum 25 (OH) D Level, calcium and phosphorus and calcium intake are associated with metabolic syndrome. However, the mechanism of this association requires further studies.

Citation: Ghanei L, Ziaee A, Rostami P, Oveisi S, Esmailzadehha N, Kazemifar AM, Zargar A. Association of Serum 25-Hydroxyvitamin D Levels and Vitamin D Dietary Intake with Metabolic Syndrome: A Case Control Study. J Res Health Sci. 2015;15(X):xxx-xxx.

Introduction

Vitamin D (Vit. D) has various roles in human life including bone and muscle functions, and normal growth[1]. Its roles in bone mineralization, promoting intestinal absorption of calcium and phosphorus, prevention of cancer, both through genomic and non-genomic mechanisms, adjustment of immune system functions, and glucose homeostasis has been confirmed. Vit. D deficiency would result in various diseases such as rickets, osteoporosis, bone fracture, certain types of cancers, hypertension, cardiovascular diseases, multiple sclerosis, type 1 diabetes mellitus, autoimmune diseases, and dental diseases[2-4]. 1, 25 $(OH)_2$ Vit. D mediates function of more than 200 genes; include genes responsible for synthesis of renin, insulin, and cytokines[2].

Despite its importance in body homeostasis, Vit. D deficiency is highly prevalent worldwide[5, 6]. It has been claimed that 30-50% of children and adults in different parts of the world suffer from Vit. D deficiency[6-8]. It has even been about twice more prevalent in Chinese elderly and Korean menopaused women[9, 10]. The same is true for Iranian[6, 11, 12].

Metabolic syndrome (MetS) is defined as; central obesity, insulin resistance, abnormal glucose tolerance test, hypertriglyceridemia, low level of high density lipoprotein cholesterol (HDL), and hypertension. It is associated with risks of diabetes, cardiovascular diseases, and their resultant morbidity and mortality. Its prevalence is increasing, currently known as an epidemic disease worldwide[13]. Various causative factors have been suggested for MetS; including Vit. D deficiency. There are some studies that have proposed negative relationship between serum concentration of 25 (OH) D and occurrence of MetS or its components[14,15]. However, other studies have not supported this relationship[16,17]. Theoretically, the roles of Vit. D in normal function of beta- cells of pancreas and insulin secretion and regulation of lipolysis explain the relationship between the serum concentration of 25 (OH) D and occurrence of MetS, reported to be so5, 18 but this relationship, is not found in another study[19].

Both MetS and Vit. D deficiency are prevalent in Iran as other Asian countries. Metabolism of Vit. D and prevalence of MetS are partly affected by ethnicity and lifestyle. The aim of this study was to determine the association of serum 25 (OH) D Level and Vit. D dietary intake with metabolic syndrome among Iranian population.

Methods

This analytical study was conducted on 250 subjects (122 with MetS and 128 as control group) identified in the Qazvin Metabolic Diseases Study (QMDS), Iran.

The research project was approved by the Medical Research Ethics Committee of Qazvin University of Medical Sciences. All subjects gave their written informed consent form.

Details of sampling method and data collection of the QMDS have been published elsewhere[20]. All households of the Minoodar district had profiles at the health center and the sampling unit was the household. Subjects were invited by phone call to attend the health center and after being fully explained, their written informed consent for the participation was obtained. Overall, 1107 subjects aged >20 yr old were selected by multistage cluster random sampling methods from residents of this district of Qazvin because of their similar socioeconomic status. The subjects were studied in a cross sectional design from September 2010 to April 2011. A self-reported questionnaire was used for social and demographic information. Two practitioners recorded medical history, family history, medication, and physical examination for all subjects. Waist circumference (WC), weight, height and body mass index (BMI) were measured after 12-14 h overnight fasting. In a seated position, blood pressure (BP) was measured three times by a mercury sphygmomanometer and after a 15 min rest on a single occasion. Blood levels of glucose, insulin, triglycerides (TGs), total cholesterol, high-density lipoprotein cholesterol (HDL) and low-density lipoprotein cholesterol (LDL) were measured for all subjects after 12-14 h overnight fasting and in the same laboratory. Oral glucose tolerance test (OGTT) by 75 g glucose was performed on subjects without previous diagnosis of diabetes.

MetS was defined according to the ATP III criteria if at least three of the following conditions were met: WC > 102 cm in men and > 88 cm in women, fasting plasma glucose (FPG) ≥ 100 mg/dl (includes diabetes), TGs > 150 mg/dl, HDL < 40 mg/dl in men and < 50 mg/dl in women, systolic blood pressure > 130 mmHg or diastolic blood pressure > 85 mmHg[21]. Given this information, presence or absence of MetS was known for all study subjects and 328 (30.6%) of them had MetS.

Totally, 122 subjects with MetS were selected and 128 subjects without MetS were matched for age, gender, marital status, education level and occupation as control group. Subjects with diseases related to Vit. D (such as rickets), cancer, hepatic and renal disease or on treatment with drugs that could affect the Vit. D metabolism (such as phenytoin) were excluded from this study. Serum concentrations of 25 (OH) Vit. D, Calcium and Phosphorus were measured. 25 (OH) Vit D levels were measured by ELISA using reagent (IDS Company, Germany). Mean intra- and interassay coefficients of variation were 5.3 and 4.6, respectively. 25 (OH) D concentrations above 30 ng/ml were considered as Vit. D sufficiency. Vit. D insufficiency was defined as 20< 25 (OH) D <30 ng/ml and25 (OH) D lower than 20 ng/mlwas considered as Vit. D deficiency[2]. A 168-item semi-quantitative food frequency questionnaire (FFQ) was used to calculate dietary intake. Validity and reliability of this questionnaire were confirmed previously[22]. A list of foods serving size. Food consumption frequency was self-reported by study subjects on a daily, weekly or monthly basis. The food intake was analyzed using "Nutrition 4, version 3.5.2" software (Nutrition 4, 2011).

The normality of variables was examined by Kolmogorov Smirnov test. Categorical variables were described as number (percent). Quantitative variables were described as mean ± SD. Independent samples *t*-test and Mann-Whitney U test were used to compare quantitative parameters with normal and abnormal distribution between the two groups. Chi-square test was used to compare qualitative variables. Multiple logistic regression analysis was performed to investigate the independent association of MetS, Vit. D and other potential risk factors. SPSS software version 16.0 was used for statistical analysis. *P*-value less than 0.05 were considered significant.

Results

Overall, 122 subjects with MetS and 128 subjects without MetS were evaluated. Mean age was 46.3±11.8 yr in subjects with MetS and 45.3±12.3 in subjects without MetS and the difference was not statistically significant (*P*= 0.464). The groups had no statistically significant difference in their demographic characteristics (Table 1). BMI was 24.8± 3.7 kg/m^2 (18.1-37.2) in subjects without MetS, while it was 28.3± 3.7 kg/m^2 (18.4-37) in subjects with MetS and this difference was statistically significant (*P*< 0.001).

Table 1: Demographic characteristics of the study subjects

	Cases with MetS (n= 122)		Controls without MetS (n= 128)		
Variables	**Number**	**Percent**	**Number**	**Percent**	***P* value**
Gender					0.267
Male	62	50.8	74	57.8	
Female	60	49.2	54	42.2	
Marital status					0.486
Single	8	6.6	12	9.5	
Married	109	89.3	112	88.9	
Divorced	1	0.8	0	0.0	
Widow	4	3.3	2	1.6	
Education level					0.358
Illiterate	11	9.2	5	4.2	
Less than high school	67	55.8	64	53.3	
High school diploma	28	23.3	35	29.9	
College education	14	11.7	16	13.3	
Occupation					0.571
Employed	32	26.2	32	25.0	
Unemployed	4	3.2	4	3.1	
Retired	34	27.8	46	35.9	
Housewife	52	42.6	46	35.9	

According to the ATP III criteria, 28 (21.9%), 19 (14.8%), 60 (46.9%), 18 (14.1%) and 35 (27.3%) of subjects without MetS had High WC, high BP, low HDL, high TGs and high FPG, respectively. Seventy-eight (63.9%), 62 (50.8%), 111 (91%), 96 (78.7%) and 92 (75.4%) of subjects with MetS had high WC, high BP, low HDL, high TGs and high FPG, respectively. Thirty-seven subjects with MetS and four subjects without MetS were diabetic. Of them, 25 subjects with MetS and 3 without MetS were on anti-diabetic treatment.